tain by legislation the integrity and special privileges of State banks after they enter the System—a sort of marriage vow with a reservation. It would appear to be the part of wisdom to add as few restrictions and new duties as possible to a system which already is of towering proportions, to the end that it may function smoothly, unencumbered and unembarrassed.

TWO NEEDED IMPROVEMENTS

The closest observers of the operation of the System have but few suggestions to make for changes in the fundamentals. For the most part, they are content with the Act as it stands. But there are two particulars in which it is felt that strength and efficiency could be added:

First, remove government bonds as eligible collateral for commercial paper acceptable for rediscount at Federal Reserve Banks, and thereby destroy a wide avenue for rapid inflation.

Second, reorganize the Federal Reserve Board so as to divorce it from other government activities and relieve it of the embarrassment of ex officio membership.

Economic Factors in the Location of Manufacturing Industries

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TO overcome restrictions limiting enterprises to special localities has been one of the unconscious purposes behind industrial progress. A study of the factors that hitherto have bound particular industries to favored places shows that technical or social advances have loosened the grip of such factors. These advances foreshadow greater freedom of choice in the location of future manufacturing projects. The bonds that have hobbled manufacturing business are raw materials, labor, market, power or fuel, capital and transportation. Not all of these have restricted all industries, nor are the undertakings actually affected under equal subservience to each factor, but taken together the considerations mentioned constitute the principal dominants in factory location. Yet with the exception of the market and transportation, each shows a waning power over the placement of a factory.

THE PART PLAYED BY RAW MATERIALS IN FACTORY LOCATION

Raw materials have not dictated factory location to the extent that they necessarily determine mining—where there is no coal there are no tipples, and concentrators are useless where copper ore does not exist—for even the first factories both in Manchester, England, and Pawtucket, R. I., were leagues distant from the cotton fields of the West Indies, the Carolinas and Georgia. Nevertheless, bulky, cheap, fragile or perishable raw materials have usually limited factories using them to the neighborhood where the materials exist. In fact, in the case of bulky cotton cited above, the works that today are remote from our South specialize on cloth that has more value in skilled labor than in raw material while heavy cheap stuffs whose chief value lies in the contained cotton are made where cotton grows.

Thus Manchester produces batiste, New Bedford, the highest grade sheeting or muslin, while Greenville, S. C., turns out weighty duck. Similarly, heavy clay is baked into bricks where the clay lies, and heavy wood is fashioned into clothespins, coat hangers, rolling pins and mixing bowls within the shade of the forest itself. The fragility of coke prevents its shipment for distances beyond six hundred miles because the bumps and jars of railway travel reduce valuable lumps of coke to useless dust that blows away. Since the highest known grades of coking coals are found at Connellsville, Pennsylvania, near Pittsburgh, the latter city has had a unique advantage that largely explains its supremacy in the manufacture of iron and steel; for in making pig iron a pound and a half of coke must be added to every pound of ore. In like manner, hemlock and oak bark are too fragile to withstand long railway hauls so that tanneries in the past utilizing the bark as the source of tannic acid were forced to establish themselves where the trees grew and, when one supply was cut off, to move to a virgin stock. Massachusetts, Pennsylvania and Tennessee have each in turn supported a forest tanning industry.

Again, perishable raw materials must be turned into durable products near the origin of the materials. Maine farmers in northern Aroostook County were once famed for changing perishable potatoes into lasting starch; this year when prices of potatoes dropped from three dollars a barrel to forty cents, the northern farmers were saved by the starch factories, whereas their friends in the southern part of the county dumped 45,000 barrels of potatoes into their fields for fertilizer. Campbell's Camden soup factory saves New Jersey tomatoes from spoiling in the field or in transit. Cotton gins are on the edge of plantations because seed cotton ferments in short order; and for like reason the seed mill abuts the gin.

CONCENTRATION AND SUBSTITUTION OF MATERIALS LOOSEN THE SHACKLES OF LOCATION

Since raw materials have imposed these limits upon certain types of manufacture, the conditions challenged the men engaged in the industries to devise means of throwing off the constraints. Concentration from a lower to a higher percentage of valuable content has permitted the long distance shipment of some raw materials that otherwise would have been refined at the source. Copper smelters of Butte concentrate ingots of copper that may then be carried to Newark, N. J., for final refinement. Minnesota iron ore is not shipped "as it runs" but is first graded upward and then sent to blast furnaces at Duluth, Cleveland, Erie, Conneaut, Pittsburgh and Buffalo. In the tanning industry, freedom from the necessity of a forest location was long since attained by leeching the tannin from the bark and shipping the resultant "extracts" to convenient sources of hides or markets. The canneries have not yet been loosened from the fields or orchards but the difficulty is under study. Cold storage has lengthened the distance and time from bush to can, and now the enthusiasm over vitamines promises a new release. Extract vitamines from fruits or vegetables and decay is arrested. If this be true, the limitation upon cannery location is removed. If none of the manipulations of raw materials suggested proves feasible in a given case, there is always the possibility of release by substitution.

Pittsburgh's virtual monopoly of the best coke has been defied by the invention of ovens that take ordinary grades of coal and, by saving the by-products, turn out a good quality coke at a mod-

erate price. Recent reports of the Federal Trade Commission indicate that if it were not for the common ownership of Pittsburgh mills and those at Duluth, Birmingham and elsewhere, Pittsburgh could not hold its own in competition. As it is, the higher Pittsburgh costs are set as the base levels in determining prices for the nation regardless of cheaper costs in more accessible localities.

Substitution of raw materials has taken place in the furniture industry, particularly the branches dealing with office, kitchen and hospital furniture. Wood is replaced with steel. The greater accessibility of steel, of course, is only a partial reason for the change; high price of wood due to declining supply must be taken into account. The paper business for centuries held in leash to large cities, especially ports, so as to be supplied with the all essential linen rags, found greater freedom fifty years ago when wood pulp was substituted for rags. Paper mills that had been localized near Philadelphia were scattered along the edge of the forests from Maine to Minnesota. So far as raw materials are concerned, therefore, industry by concentration or substitution is apparently passing out of bondage in regard to location of plants. An analogous story may be told in respect to labor.

SKILLED LABOR AS A FACTOR IN THE LOCALIZATION OF INDUSTRY

Nearly every industry in its youth has been subservient to skilled labor, and many of our important manufacturing enterprises are still in thraldom to labor. Sanitary pottery is entirely the work of skilled hands with no intervention of machinery. Glass blowing is a matter of lungs, legs, and fingers. Shoe manufacture was a hand trade until after the Civil War, and although every operation may now be done by machines, the latter require skilled labor in their operation. This labor is so well organized that it virtually controls the shoe business. Wherever skilled labor is an important item of production, the home of the labor determines the location of the industry. Ties of sentiment and property hold the skilled labor together in one place so that employers must go where the labor lodges.

The result is a high degree of localization of industry, one of the most outstanding features of American manufacturing; indeed the names of many American towns are nearly always associated with the principal product of the place—an industrial hyphen. As a basis for such an assertion one need but mention Brockton or Lynn-shoes, Waterbury-brass, New York-clothing, Troy-collars, Bridgeport-corsets, New Bedford-cotton, Gloversville-gloves, Philadelphia-hats, Providence-jewelry, Akron-rubber, Patterson-silk and Chicago-packing houses. The essential common factor in all these localized industries is need and dependence upon skilled labor.

THE LESSENING SIGNIFICANCE OF SKILLED LABOR AS A DETERMINANT OF FACTORY LOCATION

But labor's skill is an ephemeral prize. Machinery, sub-division of labor, multiplication of industries or trades blot out trade distinctions and tend to reduce all labor first to semi-skilled but eventually to the unskilled basis. Indeed the mere existence of skilled labor's power over industry is a challenge to employers to find a way to offset this authority. Transference of skill to perfected machines is one step in the desired direction. Simplification of jobs together with specialization upon the simplified tasks continues the course.

Of great assistance to employers in

these matters is scientific management with its motion, time and fatigue studies, together with functionalization. A thorough installation of scientific management leaves little of skill monopoly in the hands of labor. Except as upspringing new industries, the power of organized labor, and the resistance of inertia delay the movement, the trend is away from skilled labor and toward one universal class of unskilled. The significant feature for our purposes of such a change is that unskilled labor has no pride of locality, no roots running deeply and intertwined into the community that an employer is bound to respect. Whereas skilled labor, without change of residence, draws the factory to itself, the unskilled must seek the factory wherever the owners choose to put it.

Consequently, localization of industry based upon skilled labor is likely to be of continuously less significance. Electrical porcelain potteries differ from sanitary potteries in that the former use machines largely, and employ semi-skilled labor. While sanitary ware manufacture is localized at Trenton, N. J., or East Liverpool, Ohio, electrical porcelain is manufactured in a score of scattered places. Glass manufacture, long under the dominion of labor, has substituted compressed air for lungs, molds for skilled fingers, and travelling belts for legs. Hence glass blowers are losing their aristocratic bearing, and factories may seek locations regardless of labor domination. The trade was once centered in New Jersey, but today it is practiced in western Pennsylvania, Ohio, West Virginia and Indiana.

A few shoe manufacturers have started making footwear upon the same principles of standardization as Ford cars. If the experiment succeeds the way is opened to escape from the restrictions upon location due to labor; for standardization of leather, lasts, methods and internal factory transportation removes the insistent need for skill. Brass casting, long an hereditary secret among selected casters in Connecticut, is now under the control of the chemical and physical laboratory. Significantly, it is Buffalo, not Waterbury, that blazes the way with the new scientific methods. Collars in Troy may be made by machines; the principal reason why so many of them are not is the influence of changing styles upon standardization. In short, the attack has been carried into every localized stronghold, and has been so successful that the phenomenon of localized industries due to skilled labor is yearly harder to demonstrate and promises to disappear. If it does, the hold of skilled labor upon the location of a factory is broken. Questions of labor quantity, not quality, will then be raised when a factory location is considered. Since the sands of Lake Michigan can be turned into a Gary, and the mountain fastnesses of Mingo County into a Matteawan, the temporary absence of unskilled labor from a particular location is not a vital matter and may be remedied.

NEARNESS TO MARKET CONTINUES TO CONTROL THE LOCATION OF MANUFACTURING PLANTS

The third great factor that has most often fastened factories to specified localities has been the need to be near markets. Of course, with this as with the other factors mentioned, some industries are more vitally concerned than others. Products that are easily broken, bulky, or are needed for quick convenience are most under the domination of market. For example, pottery is hard to ship without breakage and consequently the potteries find their best location near the places of largest

sale. For this reason Ohio leads the nation in making drain tile, a product in great demand for the farms of Ohio, Indiana, Illinois and Iowa. Since agricultural tools ordinarily are not only bulky but also must be repaired without delay, they are manufactured as near the farm as is convenient. Corn belt tools are made at Chicago and Springfield, Illinois, while the wheat belt—Kansas, Nebraska, the Dakotas and Minnesota—receives its farm implements from Chicago, Moline, Rock Island or Davenport.

The manufacture of textile machinery and equipment in Worcester and Providence near the large textile centers of Massachusetts, illustrates the factor of convenience. It is a simple matter to make quick repairs and adjustments when the machine manufacturing industries are near the machine-using industries. In general it may be said that nearness to market is the most important of location considerations to the largest number of manufacturing enterprises.

Unlike the cases so far mentioned, industrial progress has not materially lessened the power exerted by the market factor. Nevertheless there have been attempts to combine large scale industry and even localized manufacture with decentralization of plants near to the final consumer. The manufacture of Ford cars is a case in point. The principal plant, of course, is at Detroit, but all the large distributing centers have assembling plants of considerable size. These plants also manufacture some small parts and do much repairing on cars already sold. This scheme admits of large scale production of the principal parts of the car at Detroit with cheaper shipment in the knock-down state to the sub-manufacturing unit, sand then the assembling and final shipment to the consumer from these units.

Although the Ford car is spectacular in this device, it is by no means unique. Similar schemes are practised in many other trades. Montgomery Ward & Company, the large mail-order house, in addition to its principal warehouse at Chicago, has branch houses at St. Paul; Portland, Oregon; Fort Worth, Texas, and Kansas City, Missouri. Furthermore, the large shoe manufacturing concerns of eastern Massachusetts have branch plants in St. Louis and Cincinnati. Even with a new type of transportation or with the changes indicated below in regard to transportation, the factor of nearness to market is likely to have an enduring influence upon the location of manufacturing plants, for the factory nearest to the market will always have an advantage over one more remote.

POWER AND FUEL AS INDUSTRIAL SITE CONTROLS

Among other matters that have had a bearing upon where a factory should be built have been the factors of power and fuel. The earliest factories used so little power and the machines were so small and light that small streams could be harnessed and made to render service. The parts of the United States that were then settled were provided everywhere (except in the extreme Southern Atlantic Coastal Plain) with small power sites. But after the invention of the power loom and the erection of the first complete factory at Waltham in 1814, the situation changed. Large water powers from that time on became increasingly important. Such sites were limited in number. Therefore manufacturing tended to collect about the available sites. Instances are Lowell, Lawrence, Holyoke, Paterson, Woonsocket and Norwich. These sites were open to the usual objection to water power, namely, that it is confined to the power available at a par-

ticular spot and has definite limits to expansion.

Increasing demand for products, and hence search for power in order to take care of the necessary increase in manufacturing facilities, eventually led manufacturers to adopt steam in the place of water power. Although the steam engine was improved and its manufacture cheapened, nevertheless at the time that it began to supersede water power, the latter was by far the cheaper source of power, costing only about a fourth as much per horse power per year as steam. The principal reason why the steam engine came into almost universal use was the elasticity and freedom with which it might be set up. Steam really liberated manufacturers in their choice of location, for a steam engine will operate anywhere that fuel can be secured. Unless power is a very large element in the cost of production, however, the cost of coal has very little influence upon the location of a mill. If power is a small item in total costs, then this cost may be tripled or quadrupled without vitally affecting the total cost of the products manufactured.

However, even steam does not give the widest choice of location. The limitation upon the use of steam power is the securing of cheap fuel. Fuel is cheapest at points nearest to the coal fields and expensive in proportion to the distance from the mines. There is a final limit to the distance which coal can be carried economically for manufactures. This limitation partly explains the absence of manufacturing from such places as North and South Dakota, Kansas and western Texas.

Another source of power and fuel is crude oil or natural gas. In regard to crude oil, the story is much the same as in respect to coal. Natural gas is more limited in its range from the source of supply than either coal or crude oil. Although West Virginia gas has been utilized as far distant as the glass works of Muncie, Indiana, necessity of transporting the gas through pipes, limits in general the distance that it can be carried for economic use.

ELECTRICITY CURTAILING THE POWER FACTOR AS A DETERMINANT OF INDUSTRIAL SITES

The factor which tends to liberate manufacturers from the constraint of any of the power or fuel sources mentioned is the transference of energy into the form of electricity. Power developed from the Mississippi operates mills in all the little towns of western Illinois within the radius of Peoria and Springfield, while Connecticut River power harnessed below Brattleboro operates machinery in Providence On the Pacific Coast hydro-electric power has been carried 500 miles before it was used. Similar proposals are being made to develop electricity from coal at the mine. If the various sources of electrical energy, either from water or coal, in the East were joined in one super-power system, then there would be no region east of the Alleghanies that could not use electrical power in any amounts necessary.

A similar development from the fuels and the water powers of the Middle West would give ample power to the whole region. By turning the low grade fuels found in North and South Dakota and Texas (lignite) into producer gas and then changing the energy into electricity, these regions also could be supplied with the essential that they have so far lacked. The New Salem field of North Dakota alone is estimated to contain two billion tons of lignite. It has a tested heat value of 6700 B. T. U. Translated into dollars, this means that at $5 a ton the prairie lignite is equal to Pittsburgh bituminous coal at $10.20 a ton. If instead of

steam engines—the basis for the foregoing—the lignite were gasified and then made into electricity, its value would be even greater. The streams of the Rockies and the Cascades could be turned to commercial advantage in the Far West, as some of them already are. Therefore, even under the limitation of transmission of power by wire there is no region of the country that is beyond the feasible range of transmission of electrical energy.

When one indulges in prophecy and deals with the attempts to transmit electrical power by wireless, then he faces the possibility that there may eventually be no place without the service of any amount of power required. Such an industrial opportunity is far removed from the constrictions in power that first faced the manufacturers of this country and led them to erect "Lowells" and "Holyokes." So far as power is concerned, Death Valley and New York City would be equally available as factory locations.

CAPITAL, UNPROVINCIAL, THE LEAST OF THE FACTORS AFFECTING THE LOCATION OF INDUSTRIES

One other factor which sometimes has a bearing upon the location of factories is capital. There are men, the possessors of surplus funds, who will not invest them in any project that they cannot keep under their own eyes. The retired whaling captains of New Bedford, seeking investment when whaling declined, would not support projects as near by as Fall River but insisted on putting their money into "home enterprises," thus establishing New Bedford as a cotton mill city. Insofar as such individuals exist, they tend to keep manufacturing local wherever the enterprise depends upon local funds.

But for the most part, capital is not provincial; Beacon Street's timid old maids furnished part of the capital for the roaring copper towns of Butte and Anaconda. Furthermore, capital is not national; in itself it has no patriotism. The Pennsylvania railroad is owned in part by the widows and orphans of Scotland, while on the contrary, 73 per cent of the Canadian Pacific railroad is owned by people in the United States and only 17 per cent by Canadians or British. Mexican oil is shared in its exploitation by American and British interests, while the World War focused attention on the extent of German ownership of French, British and American industries. Wherever there is a reasonable assurance of gain and a minimum risk, there capital can be secured. Consequently, a man desiring to set up a factory would not ordinarily have to depend upon local capital to support his project. If it gave reasonable assurance of success, capital, even from distant points, could be secured for financing the enterprise. So we can set down capital as the least of the factors that have a bearing upon the location of industry.

HOW RAILROAD RATES FIXED INDUSTRIAL CENTERS

Interwoven with all of the factors so far considered is the vital matter of transportation. Lack of transportation thoroughly decentralizes industry. The earliest stages of manufacturing in this country when all industry was of the local type exemplified by saw mills and grist mills, well illustrate how absence of carriage facilities constricts business. The progress of railroad building from 1828 to 1900 was a most essential element in determining manufacturing activities in the United States. Railroad policy was a vital influence in the growth and preëminence of eastern manufacturing.

In order to bind the whole nation together and to encourage the use of

railroads in thinly settled regions, it was a necessary part of railroad strategy to fix freight rates at the lowest possible point. As a result, between 1828 and 1916 railroad freight rates were successively revised downward. Furthermore, the rates were arranged to give precedence to the long haul over the short haul. It was to the interest of the railroads, since they made their profits on the long rather than the short hauls, to keep manufacturing localized in the East where it first developed and to prevent wide decentralization of manufacturing in the western agricultural regions.

Rates were also adjusted so as to give undue favoritism to the large Eastern seaboard cities. This led to the building of great centers of population in the East specializing in manufacture and the wide dispersal of agriculture in the Middle and Far West. The result was a long haul for manufactured articles westward and a long haul of agricultural products eastward. Some of the farm output was necessary to feed congested areas in the East, but in addition large amounts of it were raw materials for the factories of the East. It is a little-appreciated fact that factories secure three-fourths of their raw materials from farms, and that half of the farm products go to factories. The fixing of rates as indicated was a part of a necessary stage in the economic development of the United States and criticism cannot justly be levelled against it. Without such an arrangement it is difficult to see how a continent so quickly could have become a nation.

PRESENT TENDENCIES POINT TO DECENTRALIZATION

But the period when these things were necessary has passed. The country is now settled from coast to coast. There is no need for keeping the industrial development of one region artificially stimulated and another region artificially retarded. For many other reasons not germane to this subject, the whole railway industry is under intensive scrutiny and faces epochal changes. The matter of the long haul and the short haul is likely to be changed in the general reorganization of the railway system, which is imminent. It seems likely that the railroads may soon be under the control of the government again and operated for service rather than profit. Among other reforms that seem probable is the adjustment of rates on the basis of service rendered. This means that rates will probably be placed upon a mileage charge plus a charge for terminal facilities.

If this occurs there will be a rapid decentralization of manufacturing. Then localization of industry no longer will be profitable. Nearness to raw materials and especially nearness to market will be enhanced as factors to be considered in locating a factory. The great centers of population in the East will be vitally affected. Without artificial support from the railroads the centers could not continue their industrial supremacy. Insofar as the eastern cities turn their attention to the manufacture of articles using imported raw material or manufactured articles for export, their manufacturing plants could be retained and even increased. The commodities needed by the people living in the East also could be manufactured in that region but the vast consuming market in the Middle West would be removed from the dominance of eastern manufacturers and supplied by factories in the Middle West itself.

In fact, the Middle West is likely to witness a rapid increase in its industrial activities. It is not without meaning that the state of Michigan led

the nation between 1910 and 1920 in increase of population. All of the natural factors favoring manufacturing are to be found in the Middle West. Raw materials from the farm and from the mines are easily available, power and fuel are at hand, living is cheap because of the prevalence of farms, and labor is available, especially that of women.

How the Westward Movement Favors the Worker

On the human side it is far more desirable to have a large number of relatively small factories scattered through the small cities and towns of the Middle West than it is to have great plants erected in the large cities of the East. The life of an artisan in a large city is often figuratively expressed as machine slavery, and the facts of the life—tenements, scorching grassless pavements, noise, violence, disciplined attendance at work, ceaseless fear of the arbitrary life and death decisions of employers—do not give the lie to the name applied. The vaunted advantage of the city in supplying amusement is usually limited to pipe smoking of evenings, coatless on the airless front steps. Of course there are movies too—but every hamlet has its movies.

On the other hand, workers in a Mid-West factory in a moderate sized town escape tenements for cottages, combine gardening with shop craft, sleep in quiet, and, because the "boss" and his men have many intimate social contacts outside of working hours, the rigor of discipline is lacking during the work day. Furthermore, the artisans of the smaller places and some of the large are mostly American born. Kansas City holds first rank among our cities by her verified claim that 85 per cent of her citizens are born in this country. From the human viewpoint therefore, a shifting of factories to the Middle West is advantageous.

New Factors in Transportation

The new factor in transportation, the automobile truck, foreshadows a quickening of the decentralization of industry. The truck has already demonstrated its ability to compete with railroads for distances of fifty miles. If the railroad is forced to concentrate its efforts on short haul business it will come in conflict with the truck. Rates ought to reflect this competition; if they do, then more than ever will it be advantageous to put a factory within short reach of its raw materials and especially its market.

As regards the airship, the latest transportation agent, speculation as to its development is dangerous in the face of the achievement of the automobile. Even now planes flying 120 miles an hour have reached an engine efficiency of twenty miles to the gallon of gasolene. No automobiles at that speed have ever attained so high a mileage and few cars at any speed have reached it. Nevertheless, it appears that the air craft for some time will be limited to carrying small valuable packages, or those in which speed of delivery is of importance. If they do offer serious competition to the railroad or truck, they will turn the tide of industrial decentralization backwards and permit centralization because they mitigate consideration of distance or time. But one fact stands out—however efficient and cheap air transport becomes—it will always remain true that the producer nearest his market has an advantage over his competitors. This truth will in the future as now exert a powerful leverage toward decentralization.

In general the ordinary considerations that have limited the choice of factory location—raw materials, labor,

market, power or fuel, capital and transportation—have been shown to have lessening force as industrial progress has been made. To this generalization two partial exceptions have been made, —one in respect to market and the other as to raw materials. Under the new freedom as regards most of the factors of location, but limited by the changes in transportation, we have indicated the likelihood of the important rôle to be played by the Middle West. The selection of a location for a factory should not be made until serious thought has been given to reasoning of this character.